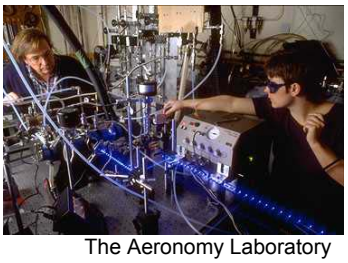
Aeronomy Laboratory

Understanding our complex atmosphere



The Aeronomy Laboratory conducts laboratory experiments to study the chemical reactions and properties of atmospheric gases and particles that are important to improving NOAA's predictions in climate, air quality, and ozone depletion.

The NOAA WP-3D research aircraft becomes a "flying chemical laboratory" to study atmospheric processes as part of air quality and climate field studies organized by the Aeronomy Laboratory and involving colleagues in other NOAA Research laboratories and in other agencies and universities.

The Aeronomy Laboratory conducted research that discovered the atmospheric chemical processes that cause the Antarctic ozone hole. The Lab continues to study the chemistry and dynamics associated with the recovery of the stratospheric ozone layer and the interactions between ozone depletion and climate change.

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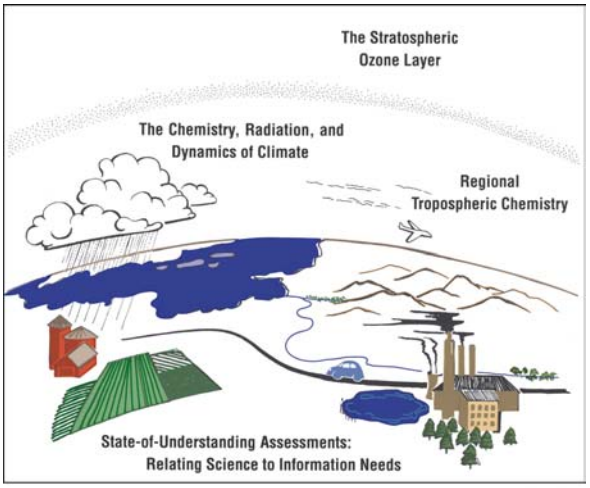
What does the Aeronomy Laboratory do for the nation?

The Aeronomy Lab's research findings provide a sound scientific basis for decisions made in industry and government related to climate change understanding, air quality improvement, and ozone layer protection.

Mission: The Aeronomy Laboratory conducts scientific research aimed at understanding the chemical, dynamical, and radiative processes of the Earth's atmosphere that are needed to improve the capability to predict its behavior. The chemical, dynamical, and radiative processes of the atmosphere are the mechanisms of atmospheric change. As such, their identification and characterization are a fundamental necessity for building better models for predicting the behavior of regional and global phenomena, which is at the heart of NOAA's mission. The Aeronomy Laboratory currently focuses on understanding the atmospheric processes important to model predictions of changes in climate, regional air quality, and the stratospheric ozone layer.

In this "information-user" context, Aeronomy Lab scientists conduct investigations of the atmospheric processes under controlled conditions in the laboratory, carry out field measurements in a variety of environments, and use diagnostic models for analyses and interpretations. The Aeronomy Laboratory also assists the scientific community in its periodic efforts to assess the current state of scientific understanding and to interact with those who use this information, describing it in "user-friendly" terms. In this regard, an Aeronomy Lab researcher cochairs the climate-science Working Group of the Intergovernmental Panel on Climate Change (IPCC), and the Lab hosts its Technical Support Unit.

Recent Accomplishments:



- Used a new instrument developed at the Aeronomy Laboratory to obtain the first chemical "fingerprint" of the *individual* aerosol particles that are effective in causing cloud formation. ***Payoffs: By identifying the chemical makeup of the less than 1% of ambient particles that are effective cloud condensation nuclei, this research will improve the capabilities of NOAA's Climate Services Program to predict cloud formation, thereby enabling more accurate model estimates of the climate and radiative implications.***

- Discovered new factors that cause ozone pollution in the Houston, Texas area, showing that leaks of reactive gases from the petrochemical refineries prevalent in the region are a much, much larger factor than had been expected. ***Payoffs: These research results have altered the policy approach taken by Texas air quality managers, at a savings of 70,000 jobs and $1B for the state, and are an example of key discoveries needed by NOAA for improved air quality forecasting.***

- Analyzed past and recent observations to show that tropospheric ozone levels in trans-Pacific air reaching the U.S. West Coast from Asia has increased by about 30% near the surface over the past two decades, demonstrating that a "natural," unperturbed Pacific no longer exists. ***Payoffs: The increase in this greenhouse gas influences the radiative forcing of climate and also has implications for regional air quality on the U.S. West Coast.***

- Played extensive roles in leading, authoring, reviewing, editing, and/or publishing international scientific state-of-understanding assessments on three topics: the climate system, pollutant fine particles, and the stratospheric ozone layer. ***Payoffs: These information products provide key scientific input to pending national and international decisions regarding these three societally-relevant topics.***

What's next for the Aeronomy Laboratory?

Science challenges focused upon in the next 5 - 10 years:

- **Climate Change: Chemical Composition, Radiation, and Clouds**
  - How well do we understand the role of aerosol processes in controlling radiation, the formation and chemistry of clouds, and the alteration of atmospheric chemical composition?
  - What is the role of intercontinental transport and chemical transformation on regional atmospheres and on global climate?
  - How well do we understand the radiative effects of water vapor and trace gases in the atmosphere?
- **Regional Air Chemistry**
  - What are the factors (such as nighttime chemistry and sea-to-land transport) that contribute to ozone pollution in the New England region of the U.S.?
  - What measurements and diagnostic analyses are needed as the scientific foundation for the emerging NOAA air quality forecasting service?
  - What regionally-dependent factors influence the formation of atmospheric fine particles and their chemical composition across the chemically-diverse U.S.?
- **Stratospheric Ozone Layer Recovery**
  - How best can we anticipate, detect, and interpret the recovery of the global ozone layer and the Antarctic ozone hole?
  - How will climate change affect the ultimate recovery state of the ozone layer, and how will changes in the ozone layer affect climate?
  - What is the "ozone friendliness" and "climate friendliness" of the series of proposed substitutes (e.g., the new very short-lived species) for the now-banned ozone-depleting compounds?

Research Partnerships:

The Aeronomy Lab works with the University of Colorado's Cooperative Institute for Research in Environmental Sciences (CIRES). This Joint Institute was established in 1967 to provide a setting for collaborative research and teaching in the wide-ranging disciplines of the environmental sciences. The Aeronomy Lab also has research and scientific leadership partnerships with colleagues from other NOAA/OAR laboratories, other NOAA Line Offices, the NOAA joint institute AIRMAP in New Hampshire, other federal agencies, private industry, and scores of universities and organizations worldwide.

Budget and Staff

The FY 2003 enacted budget for the Aeronomy Laboratory budget lines totaled $10.1M, and its request for FY 2004 totaled $10.8M. The Aeronomy Lab has 42 federal employees and 61 Joint Institute employees.

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